

## §20. Analyses of Generation and Behavior of Fine Particles by Laser Light Scattering in LHD

Hayashi, Y. (Kyoto Inst. Technol.),  
Masuzaki, S.

*In-situ* measurements and analyses of dust behaviors is important issues to reduce the generation of dusts in a nuclear fusion reactor, because dusts generated in a practical nuclear fusion reactor will bring serious problems to become sources of core cooling and tritium pollution. The Mie-scattering ellipsometry that was developed for monitoring the growth of fine particles in a processing plasma<sup>1)</sup> can be a useful method for the analysis of dust growth and behavior in a nuclear fusion reactor. We have been developing a Mie-scattering ellipsometry system for the analysis of generation and transport of dusts in the Large Helical Device (LHD).

In this year, we installed the laser-light source and detector modules of an ellipsometry system with an optical fiber. We also carried out preliminary experiments to confirm the possibility of dust observation and analysis.

The laser-light (532 nm) source and detector modules of the ellipsometry system were attached to the view-windows of AD01-02 and AD01-03 of the 4.5 L port, respectively, as shown in Fig.1. Under the atmospheric condition of LHD vacuum chamber, the detection of scattered light transmitted through the optical fiber from the position of dust observation was tested and confirmed. However, the volume of outgas from the optical fiber under 100 °C was measured in an preliminary experiment to exceed an allowable value. Hence, the use of the optical fiber in the ellipsometry system was abandoned.

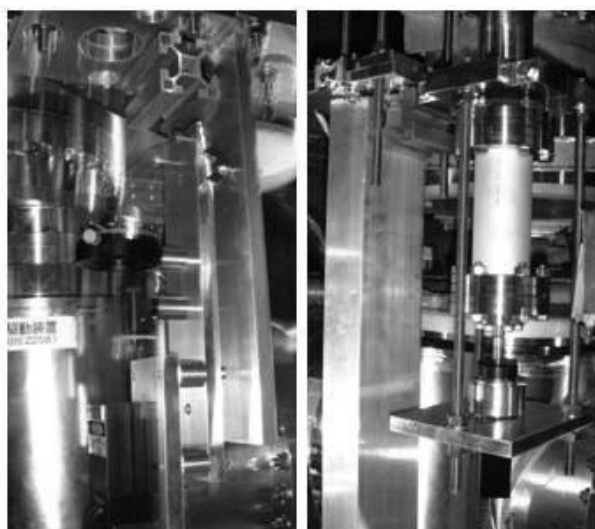


Fig. 1. Laser-light source module (left) and detector module (right) of Mie-scattering ellipsometry system attached to view-windows of AD01-02 and AD01-03 of 4.5 L port.

Instead of the detector module and optical fiber, a CCD camera with a magnifying lens was attached to the AD01-03 view-window. Images of inside of the 4.5 L port were recorded during the discharge of LHD. Fig.2 shows the images obtained during the discharge with and without 532 nm optical filter in front of the CCD camera. The upper image of Fig.2 shows that obtained without the filter just before the letup of discharge (#112367). The lower one shows that obtained with the filter just after the breakup of plasma (#113337). Because the emission of background light from plasma was extremely intensive, the inside image was hardly recorded even if the FWHM of the filter was 3 nm. In the lower image of Fig.2, there is observed a light spot, which is like that of light scattered by dusts. The origin of the spot is under examination.

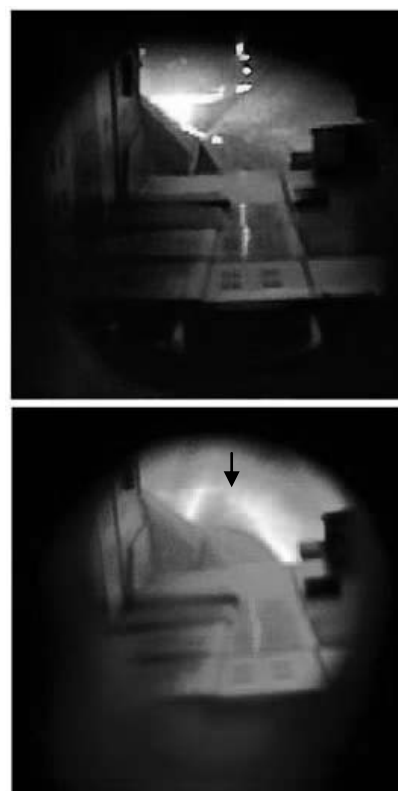


Fig. 2. Video images of inside of 4.5 L port during discharge of LHD without (upper) and with (lower) 532 nm optical filter.

- 1) Y. Hayashi and K. Tachibana: "Mie-Scattering Ellipsometry for Analysis of Particle Behaviors in Processing Plasma", Jpn. J. Appl. Phys. **33** (1994) L476.